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IS 9654 (1993): Information on ferrite materials to be supplied by manufacturers of transformers and inductors cores [LITD 5: Semiconductor and Other Electronic Components and Devices]

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ट्रांसफार्मरों एवं प्रेरक कोडों के निर्माताओं द्वारा पूर्ति करने के लिये फेराइट धातुओं में बने की सूचना

(पहला पुनरीक्षण)

Indian Standard

INFORMATION ON FERRITE MATERIALS TO BE SUPPLIED BY MANUFACTURERS OF TRANSFORMERS AND INDUCTOR CORES

(First Revision)

UDC 621·318·1 : 621·3·042·1 : 621·314·1/2·621·318·43

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

February 1993 **Price Group 2**

Magnetic Components and Ferrite Material Sectional Committee, LTD 13

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Magnetic Components and Ferrite Materials Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

For various reasons a manufacturer may wish to publish in his catalogue, typical data for material parameters as measured on test pieces. It is the object of the present standard to promote the comparability of such information in the area of soft ferrite materials.

It should be recognized, however, that there is no direct relation between material characteristics as measured on test pieces and the corresponding parameters measured on other cores, made of the same material, because of difference in geometry, etc. Also the extrapolation of material characteristics to other flux densities and other frequencies will not permit a valid comparison of cores of different materials under these new conditions of operation.

It is therefore emphasized that it is impossible to design and specify a core on the basis of material properties published by a manufacturer in his catalogue, without due contact with that manufacturer. Also, the publication of material characteristics should not be considered as a guarantee for core properties; for this, only the specification of that core shall be used.

It is strongly recommended that, together with the material characteristics, manufacturers publish a note covering the two above statements on the limitations of this kind of information.

This standard was published in 1980 and while revising this standard, a new property, namely, amplitude permeability has been added. Secondly, the measurement temperature has been changed to 25°C from 27°C to be in line with current international practice. In addition, the measurement frequency for measuring power loss also has been revised to 25 kHz from 16 kHz.

This standard is based, without any technical change on IEC document 51 (C.O.) 282 "Guide on the format of data on ferrite materials appearing in manufacturer's catalogues of transformer and inductor cores", circulated by the International Electrotechnical Commission (IEC).

For the purpose of deciding whether a particular reqirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

AMENDMENT NO. 1 APRIL 1999
TO
IS 9654 : 1993 INFORMATION ON FERRITE MATERIALS TO BE SUPPLIED BY MANUFACTURERS OF TRANSFORMERS AND INDUCTOR CORES

(First Revision)

(*Foreword, seventh para*) — Substitute the following for the existing para:

"This standard is based, without any technical change, on IEC 60401(1993) 'Ferrite materials — Guide on the format of data appearing in manufacturers catalogues of transformer and inductor cores', issued by the International Electrotechnical Commission (IEC)."

(LTD 13)

Reprography Unit, BIS, New Delhi, India

Indian Standard

INFORMATION ON FERRITE MATERIALS TO BE SUPPLIED BY MANUFACTURERS OF TRANSFORMERS AND INDUCTOR CORES

(First Revision)

1 SCOPE

1.1 This standard gives guidance for a uniform method of presentation for the properties of soft ferrite materials and measuring conditions under which they are to be determined, for use in manufacturers catalogues of transformers and inductor cores, in order to aid the comparability of such data.

2 REFERENCES

2.1 The Indian Standards listed in Annex A are necessary adjuncts to the standard.

3 MEASURING METHODS

3.1 The measuring methods shall conform to the general procedures and precautions given in IS 7687 : 1980. The test piece for the magnetic measurements shall be a ring core, preferably between R10 and R36 as per IS 7930 : 1976, having corresponding Ae values within the range 8 mm to 100 mm. Such cores have negligible eddy current losses at the measuring frequency. Table 1 indicates recommended test conditions.

4 TABLE OF MATERIAL PROPERTIES AND MEASURING CONDITIONS

4.1 The conditions laid down in Table 1 have been chosen as representative of those that are in common use, in the sense that in the majority of cases the values now published by manufacturers will differ only slightly from the corresponding values at the measuring conditions given in the table. It is therefore expected that only small adjustments to existing catalogues will be required.

The following rules are recommended for the use of Table 1 by manufacturers:

a) Properties not of importance for the application of the material in question should be omitted;

b) Where for one property two measuring conditions are stated with one underlined, the underlined one shall be used and the other is optional;

c) When both measuring conditions are underlined, both shall be used;

d) If neither of the two measuring conditions is underlined, the choice is free and at least one shall be used; and

e) Values obtained under measuring conditions deviating from those specified in the table, may be added to those required according to items (b), (c) and (d) above.

Table 1 Material Properties and Measuring Conditions

(*Clauses* 3.1 *and* 4.1)

Property — Valid for Ring Cores only, Sizes R10 to R36 (*see* 3)	**Symbol**	**Unit**	**Measuring Conditions**				
			Frequency kHz	Field Strength kA/m	Peak flux Density mT	Temperature °C (*see* 4)	Notes
Initial permeability	μ_i	—	⩽ 10		< 0·25	25	—
Flux density approaching saturation	B	mT	⩽ 10	3·0	—	$\underline{25}$; 100*	1
Remanence	B_r	mT	⩽ 10	1·0	departing from saturation	$\underline{25}$; 100	2
Coercivity	H_{cB}	A/m kA/m	⩽ 10	1·0	departing from saturation	$\underline{25}$; 100	2
Losses at low flux density	$\frac{\tan \delta}{\mu_i}$	—	—		< 0·25	25	3
Hysteresis material constant	η_B	T^{-1}	10 ($\mu_i > 500$) 100 ($\mu_i < 500$)		B_1 B_2 1·5 3·0 0·3 1·2	25	4
Curie point	θ_C	°C	⩽ 10		< 0·25	—	—
Temperature factor (or reluctivity)	α_F	10^{-6}/°C	⩽ 10		< 0·25	between 25 and (−40† (−30 (−25 (+ 5 (+55 (+70	5
Density	ρ	kg/m^3					
Disaccommodation factor	D_F	10^{-6}	⩽ 10		< 0·25	25; 40	5
Specific resistance	ρ	Ω m m Ω m	d.c.		—	25	6
The following properties are only valid for materials used for power applications:							
Power loss (volume) density	P	kW/m^3	25 100		200 100	$\underline{25}$; $\underline{100}$	7
Amplitude permeability	μ_a	—	⩽ 25		200; 320	25; $\underline{100}$	—
Flux density	B	mT	⩽ 10	0·25		$\underline{25}$; $\underline{100}$	

*Both temperatures are to be used for material for power applications: for other applications the higher temperature is optional.

†Only for specific applications.

NOTES

1 The preferred field strength for this measurement is 3·0 kA/m. Where this value cannot be used, one of the following non-preferred values should be used:

0·4; 0·8; 1·6 kA/m

2 The field strength shall be either 1 kA/m for $\mu_i > 500$ or a whole multiple thereof (2 kA/m, 3 kA/m, etc) for $\mu_i < 500$, but at least ten times the value of the coercivity. Information should be given about the measuring method, especially the frequency.

3 Measurement shall be made at not less than two frequencies chosen from the series 1 kHz, 10 kHz, 100 kHz, etc. The losses at low flux density may be given in a curve as a function of frequency. Low level losses comprise both the eddy current and the residual losses but the former can be made vanishingly small as compared to the latter, *see* 3.

4 η_B shall be based on measurement at two flux densities B_1 and B_2, so that $B_1 < 1/2\ B_2$.

5 The measuring method shall be in accordance with IS 7687 : 1980.

6 The firing skin shall be removed from the test piece. The electric field strength shall not exceed 0·1 kV/m.

7 The power losses may be given in a curve as a function of flux density with the frequency as a parameter. The preferred combinations of frequency and flux density are as follows:

Frequencies :	25	100	200	500	1 000 kHz
Flux density :	200	100	50	25	10 mT

ANNEX A

(*Clause* 2.1)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
7687 : 1980	Methods of measurement for cores for inductors and transformers for telecommunications (*first revision*)
7930 : 1976	Dimensions of toroids made of magnetic oxides or iron powder

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Doc : No. LTD 13 (1414)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Printed at Printrade, New Delhi, India